



**SCHOOL OF PUBLIC HEALTH**  
UNIVERSITY AT ALBANY State University of New York

**Center for Public  
Health Preparedness  
Grand Rounds**

**Chemical Risks  
In Your Neighborhood**

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**Evaluations**

Evaluations can be submitted online  
University At Albany  
Center for Public Health Preparedness:  
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### Common Chemical Threats in the Household

- Bleach
- Ammonia
- Disinfectants
- Stove cleaners
- Insecticides, pesticides, vermin control

### Common Industrial Chemical Threats

- Cyanide
  - Phosgene
  - Anhydrous ammonia
  - Chlorine
  - Pesticides/insecticides
  - Volatile organo-chemicals, fuels, etc
- \* Transportation of these products throughout the country (truck, train, ships) is additional risk

### WW I Chemical Casualties

Country	#Casualties	%Fatal
Germany	200,000	4.5
France	190,000	4.2
Britain	189,000	4.2
U.S.	73,000	2.0
Russia	75,000	11.8
Bhopal	150,000	3.0

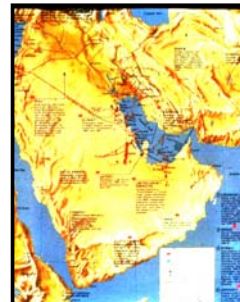
### Chemical Protection



### New Defense Equipment Developed



### After World War II



- **Location: Bhopal, India**
- **U.S. chemical company plant**
- **Manufactured pesticides: methylisocyanate from phosgene**
- **Chemical release from 55,000 gallon tank**
- **Exposure ~ 150,000 people**

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- **Disability ~ 11,000 Persons**
- **Death (immediate) ~ 3,800 people**
- **Death (next 10 years) ~ 4,000 people**
- **\$470,000,000 settlement**
- **Continuing medical insurance for 100,000 people**

## Tokyo St. Luke's Experience

- 640 patients the first day
  - 64 by ambulance
  - 35 by Fire / Police
  - 541 by non-EMS transportation (walked, bus, taxi, car)
- 528 Mild (up to 12 hours in ED)
- 107 Moderate (avg. 2.4 days hospital)
- 5 Severe, 2 died (avg. 8 days in hospital)
- 1,410 patients total by the end of week

## Tokyo: Long Term

- Overall: 12 deaths; ~1,100 with known effects; ~5,500 examined; ~4,400 with psychological reactions
- St Luke's surveyed 610 patients after the attack
  - 6 months afterward, 60% of patients had persistent psychological symptoms

## Triage at the Hospital

- Clinical experience with chemical incidents indicates:
  - Patients requiring pre-hospital CPR rarely survive
  - Small proportion have life-threatening exposure
- Conventional MCI triage techniques effectively sort critically ill from those with mild or moderate effects

## Secondary Toxic Effects

- Tokyo FD:  
135 of 1,364 responders with acute symptoms from off-gassing in ambulances
- Tokyo St. Luke's Hospital:  
110 of 472 hospital staff with symptoms of sarin toxicity



## Preventive Measures for Public Health Professional

- Risk assessment: know what industries are doing in your community
- Learn what's passing through the freight yard at midnight
- Get a copy of NIOSH Hazards Guide
- Learn how to use appropriate PPE
- Help the public understand these issues



## Nerve ( AChE ) Inhibitors (Bug Spray)

- Carbamates
  - Physostigmine (Antilirium®)
  - Neostigmine (Prostigmine®)
  - Pyridostigmine (Mestinon®)
  - Sevin® (insecticide)
- Organophosphates
  - Malathion
  - Diazinon
  - “Nerve Agents”

## Cyanide: A Commonly Used Chemical



## Use of Cyanide

- Widely used throughout the U.S.
  - Printing
  - Agriculture
  - Photography
  - Manufacturing of paper and plastics
- Over 300,000 tons produced annually
- Combustion byproduct of burning synthetic materials

## Cyanide - Characteristics

- Cyanide
  - Salts (solids)
    - sodium, potassium, calcium
  - Liquids
    - hydrocyanic acid, cyanogen chloride
- Bitter almond odor - undetected by 40% of the population
- Must be delivered in large quantities (bombs and shells) to produce death

## Acute Inhalation of Cyanide

- Low concentrations (non-lethal)
  - Victims become anxious
  - Hyperventilate
  - Develop headache, dizziness, and vomiting
  - Skin may be flushed or “cherry red” color (late)
  - Symptoms improve when victim is removed from the source

### **Acute Inhalation of Cyanide**

- High concentrations (lethal)
  - 0 to 15 seconds - anxious and hyperventilate
  - 0 to 30 seconds - seizures
  - 3 to 5 minutes - breathing ceases
  - 6 to 10 minutes – heart stops
- Normal or dilated pupils
- Initial absence of cyanosis

### **Pulmonary Intoxicants (Phosgene, Ammonia, Chlorine)**

- Cause severe life-threatening injury after inhalation
- Adverse effects often delayed
- Treatment is supportive

### **Phosgene – Characteristics**

- Colorless gas (white as water vapor)
- Freshly mown hay
- Four times heavier than air

### **Phosgene - Toxicity**

- Penetrates slowly down airways
- Symptom-free period (2 to 24 hours)
- Attacks lining of lungs causing fluid to leak into air cells (up to 1 liter/hr)
- Patients become severely short of breath
- Patients don't respond to drugs intended to reduce lung fluid

### **Ammonia**

- Colorless, water-soluble, alkaline gas
- Pungent odor
- Wide industrial use
- Used to make fertilizer, explosives, dyes, and plastics

### **Ammonia Exposure: Clinical Signs**

- Eyes
  - Burning, tearing, severe pain
  - Injury to the cornea and lens
- Lungs
  - Cough, SOB, chest pain, wheezing, and laryngitis with mild exposure
  - Hypoxia, chemical pneumonia, hemorrhage with moderate to severe exposures

## Chlorine

- Properties
  - Greenish-yellow gas
  - Less alkaline than ammonia
  - 30x more irritating to lungs than HCl
  - Chlorine + water = HCl + Free O<sub>2</sub> radicals

## Chlorine Exposure

- Eye irritation
- Cough, shortness of breath, and wheezing
- 12 to 24 hours, massive fluid in lungs
- Sudden death may occur, due to hypoxia

## Chemical Hazards Summary:

- Be aware of the chemicals used in, or transported through your town.
  - Homes
  - Farms
  - Cities
  - Industry
  - Roadways
  - Railways

## Chemical Hazards Summary:

- Conduct a chemical risk assessment and expand your chemical data base.
- Be able to present awareness level information to your public health staff and to your community response partners.

## Chemical Hazards Summary:

- Be familiar with basics of remediation and first aid.
- Know how to choose and use appropriate PPE.

## Chemical Hazards - Resources

- NIOSH: Pocket Guide to Chemical Hazards
- EPA: Recognition and Management of Pesticide Poisoning (5<sup>th</sup> edition)
- USAMRIID: Medical Management of Chemical Casualties

**Contact Information:**

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**For More Information**

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